CLAIMS

1. An electroluminescent device comprising:

a first charge carrier injecting layer for injecting positive charge carriers;

a second charge carrier injecting layer for injecting negative charge carriers; and

a light-emissive layer located between the charge carrier injecting layers and comprising a mixture of:

a first component for accepting positive charge carriers from the first charge carrier injecting layer;

a second component for accepting negative charge carriers from the second charge carrier injecting layer; and

a third, organic light-emissive component for generating light as a result of combination of charge carriers from the first and second components;

at least one of the first, second and third components forming a type II semiconductor interface with another of the first, second and third components.

2. An electroluminescent device as claimed in claim 1, wherein the first component, the second component and the third component are at least partially phase-separated in the light-emissive layer.

3. An electroluminescent device as claimed in claim 1 or 2, wherein the concentration of the first component in the light-emissive layer increases towards the first charge carrier injecting layer.

4. An electroluminescent device as claimed in claim 3, comprising a layer between the emissive layer and the first charge carrier injecting layer of a material for which the first component has a greater affinity than does the second component.

5. An electroluminescent device as claimed in claim 4, wherein the layer between the emissive layer and the first charge carrier injecting layer comprises the first component.

6. An electroluminescent device as claimed in any preceding claim, wherein the concentration of the second component in the light-emissive layer increases towards the second charge carrier injecting layer.

7. An electroluminescent device as claimed in claim 6, comprising a layer between the emissive layer and the second charge carrier injecting layer of a material for which the second component has a greater affinity than does the first component.

8. An electroluminescent device as claimed in claim 7, wherein the layer between the emissive layer and the second charge carrier injecting layer comprises the second component.

9. An electroluminescent device as claimed in any preceding claim, wherein the third component and at least one of the first and second components are provided as functional moieties of the same molecule.

10. An electroluminescent device as claimed in claim 9, wherein the third component and at least one of the first and second components are provided as a copolymer.

11. An electroluminescent device as claimed in claim 9, wherein the third component is provided as a pendant group of a polymer chain of the first and/or second components.

12. An electroluminescent device as claimed in claim 9, wherein the first and/or second components are provided as one or more pendant groups of a polymer chain of the third component.

13. An electroluminescent device as claimed in any of claims 1 to 8, wherein the first, second and third components are provided as different molecules.

14. An electroluminescent device as claimed in any preceding claim, wherein the light-emissive layer is formed by deposition of the first, second and third components together.

15. An electroluminescent device as claimed in any preceding claim, wherein the light-emissive layer comprises two or more sub-layers each comprising the first, second and third components.

16. An electroluminescent device as claimed in any preceding claim, wherein all of the first, second and third components form type II semiconductor interfaces with the others of the first, second and third components.

17. An electroluminescent device as claimed in any preceding claim, wherein the optical gap of the third component is greater than 1.8 eV.

18. An electroluminescent device as claimed in any preceding claim, wherein the first component is a conjugated polymer capable of accepting positive charge carriers from the first charge carrier injecting layer and containing amine groups in the main chain and/or as pendant groups.

19. An electroluminescent device as claimed in any preceding claim, wherein the second component is F8.

20. An electroluminescent device as claimed in any preceding claim, wherein the first component has a LUMO energy level between the LUMO energy levels of the second and third components.

21. An electroluminescent device as claimed in any preceding claim, wherein the third component is PFM.

22. An electroluminescent device as claimed in any of claims 1 to 19, wherein the optical gap of the third component is less than the optical gaps of the first and second components.

23. An electroluminescent device as claimed in any of claims 1 to 19 or 22, wherein the third component is F8BT or a soluble PPV.

24. An electroluminescent device as claimed in any preceding claim, wherein at least one of the first, second and third components is an organic material.

25. An electroluminescent device as claimed in any preceding claim, wherein at least one of the first, second and third components is a conjugated polymer material.

26. An electroluminescent device as claimed in any preceding claim, wherein the first charge carrier injecting layer is a positive charge carrier transport layer which is located between the light-emissive layer and an anode electrode layer.

27. An electroluminescent device as claimed in claim 26, wherein the first charge carrier injecting layer forms a type II semiconductor interface with the light-emissive layer.

28. An electroluminescent device as claimed in any of claims 1 to 25, wherein the first charge carrier injecting layer is an anode electrode layer.

29. An electroluminescent device as claimed in any of claims 26 to 28, wherein the anode electrode layer has a workfunction greater than 4.3 eV.

30. An electroluminescent device as claimed in any preceding claim, wherein the second charge carrier injecting layer is a negative charge carrier transport layer which is located between the light-emissive layer and a cathode electrode layer.

31. An electroluminescent device as claimed in claim 30, wherein the second charge carrier injecting layer forms a type II semiconductor interface with the light-emissive layer.

32. An electroluminescent device as claimed in any of claims 1 to 29, wherein the second charge carrier injecting layer is a cathode electrode layer.

33. An electroluminescent device as claimed in any of claims 30 to 32, wherein the cathode electrode layer has a workfunction less than 3.5 eV.

34. An electroluminescent device as claimed in any of claims 26 to 33, wherein the electrode layer or at least one of the electrode layers is light transmissive.

35. An electroluminescent device as claimed in any preceding claim, wherein the said type II interface between the said at least one of the first, second and third components and another of the first, second and third components is a luminescent type II interface.

36. An electroluminescent device comprising:

a first charge carrier injecting layer for injecting positive charge carriers;

a second charge carrier injecting layer for injecting negative charge carriers; and

a light-emissive layer located between the charge carrier injecting layers and comprising a mixture of:

a first organic light-emissive component for accepting and combining positive charge carriers from the first charge carrier injecting layer and negative charge carriers from the second light-emissive component to generate light;

a second organic light-emissive component for accepting and combining negative charge carriers from the second charge carrier injecting layer and positive charge carriers from the first light-emissive component to generate light;

the first and second components forming a type II semiconductor interface with each other..

37. An electroluminescent device as claimed in claim 36, wherein the first component and the second component are at least partially phase-separated in the light-emissive layer.

38. An electroluminescent device as claimed in claim 36 or 37, wherein the first and second components are provided as functional moieties of the same molecule.

39. An electroluminescent device as claimed in any of claims 36 to 38, wherein the first component and the second component are provided as a copolymer.

40. An electroluminescent device as claimed in claim 39, wherein the first component is provided as a pendant group of a polymer chain of the second component.

41. An electroluminescent device as claimed in claim 39, wherein the second component is provided as a pendant group of a polymer chain of the first component.

42. An electroluminescent device as claimed in any of claims 36 to 38, wherein the first and second components are provided as different molecules.

43. An electroluminescent device as claimed in any of claims 36 to 42, wherein the optical gaps of the first and second components are greater than 1.8 eV.

44. An electroluminescent device as claimed in any of claims 36 to 43, wherein the second component is F8.

45. An electroluminescent device as claimed in any of claims 36 to 44, wherein the first component is a conjugated polymer capable of accepting positive charge carriers from the first charge carrier injecting layer and containing amine groups in the main chain and/or as pendant groups.

46. An electroluminescent device as claimed in any of claims 36 to 45, wherein at least one of the first and second components is an organic material.

47. An electroluminescent device as claimed in any of claims 36 to 46, wherein at least one of the first and second components is a conjugated polymer material.

48. An electroluminescent device as claimed in any of claims 36 to 47, wherein the first charge carrier injecting layer is a positive charge carrier transport layer which is located between the light-emissive layer and an anode electrode layer.

49. An electroluminescent device as claimed in any of claims 29 to 47, wherein the first charge carrier injecting layer is an anode electrode layer.

50. An electroluminescent device as claimed in claim 48 or 49, wherein the anode electrode layer has a workfunction greater than 4.3 eV.

51. An electroluminescent device as claimed in any of claims 36 to 50, wherein the second charge carrier injecting layer is a negative charge carrier transport layer which is located between the light-emissive layer and a cathode electrode layer.

52. An electroluminescent device as claimed in any of claims 36 to 50, wherein the second charge carrier injecting layer is a cathode electrode layer.

53. An electroluminescent device as claimed in claim 51 or 52, wherein the cathode electrode layer has a workfunction less than 3.5 eV.

54. An electroluminescent device as claimed in any of claims 48 to 53, wherein the electrode layer or at least one of the electrode layers is light transmissive.

55. An electroluminescent device comprising:

a first charge carrier injecting layer for injecting positive charge carriers;

a second charge carrier injecting layer for injecting negative charge carriers;

an organic light-emissive layer located between the charge carrier injecting layers; and

an organic charge transport layer located between the light-emissive layer and one of the charge carrier injecting layers,

wherein the heterojunction formed between the transport layer and the light-emissive layer is a luminescent type II heterojunction.

56. A method for forming an electroluminescent device, comprising:

depositing a first charge carrier injecting layer for injecting charge carriers of a first polarity;

depositing a light-emissive layer over the first charge carrier injecting layer, the light-emissive layer comprising a mixture of: a first component for accepting charge carriers of the first polarity from the first charge carrier injecting layer; a second component for accepting charge carriers of the opposite polarity from a second charge carrier injecting layer; and a third, organic light-emissive component for generating light as a result of combination of charge carriers from the first and second components; at least one of the first, second and third components forming a type II semiconductor interface with another of the first, second and third components; and

depositing the second charge carrier injecting layer over the light-emissive layer for injecting charge carriers of the said opposite polarity.

57. A method as claimed in claim 56, wherein the first, second and third components are deposited together.

58. A method as claimed in claim 56 or 57, comprising the step of treating the first charge carrier injecting layer prior to deposition of the light-emissive layer to influence the phase structure of the light-emissive layer.

59. A method as claimed in claim 58, wherein the step of treating the first charge carrier injecting layer is to encourage a greater concentration of the first component near the first charge carrier injecting layer.

60. A method for forming an electroluminescent device, comprising:

depositing a first charge carrier injecting layer for injecting charge carriers of a first polarity;

depositing a light-emissive layer located between the charge carrier injecting layers and comprising a mixture of: a first organic light-emissive component for accepting and combining charge carriers of the first polarity from the first charge carrier injecting layer and charge carriers of the opposite polarity from a second light-emissive component to generate light; and a second organic light-emissive component for accepting and combining charge carriers of the said opposite polarity from the second charge carrier injecting layer and charge carriers of the first polarity from the first light-emissive component to generate light; the first and second components forming a type II semiconductor interface with each other; and

depositing a second charge carrier injecting layer for injecting charge carriers of the said opposite polarity.

61. A method as claimed in claim 60, wherein the first and second components are deposited together.

62. A method as claimed in claim 60 or 61, comprising the step of treating the first charge carrier injecting layer prior to deposition of the light-emissive layer to influence the phase structure of the light-emissive layer.

63. A method as claimed in claim 62, wherein the step of treating the first charge carrier injecting layer is to encourage a greater concentration of the first component near the first charge carrier injecting layer.